

VOCALS G-1 FLIGHTS

PRELIMINARY OBSERVATIONS

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VOCALS OBJECTIVES

1. Aerosol/CCN properties

- What is the importance of various sources of aerosols and aerosol precursors to aerosols that function as CCN?
- How does the importance these sources change with distance from the coast?

2. Aerosol and cloud microphysics

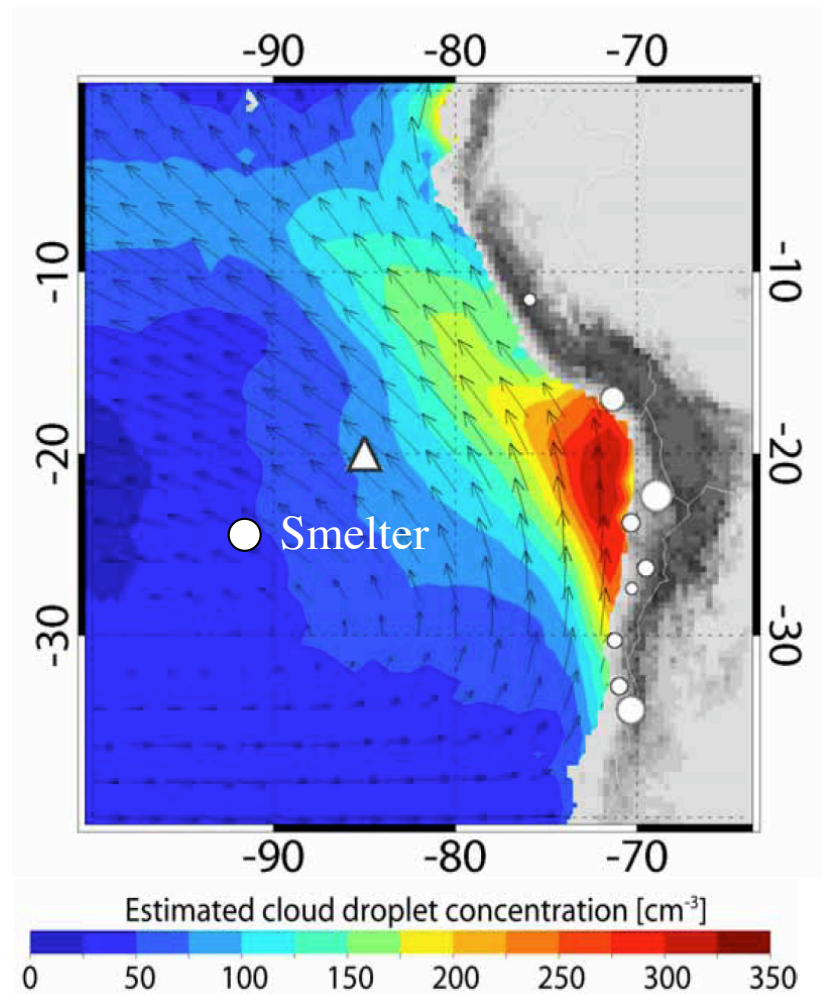
- What are the effects of aerosol loading, size distribution, and composition on the microphysical properties of the clouds.
- Are gradients in cloud droplet microphysics consistent with gradients in drizzle concentration? Are these gradients in microphysics associated with gradients in aerosol loading?
- Do newly developed parameterizations for the drizzle threshold and rate functions hold over the range of cloud properties observed over the NE Pacific?

VOCALS

**Location- Arica, Chile,
about 5 miles south of the
Peruvian border.**

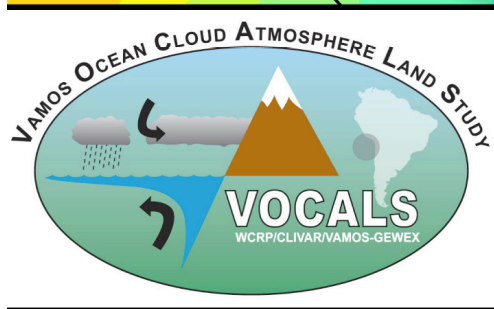
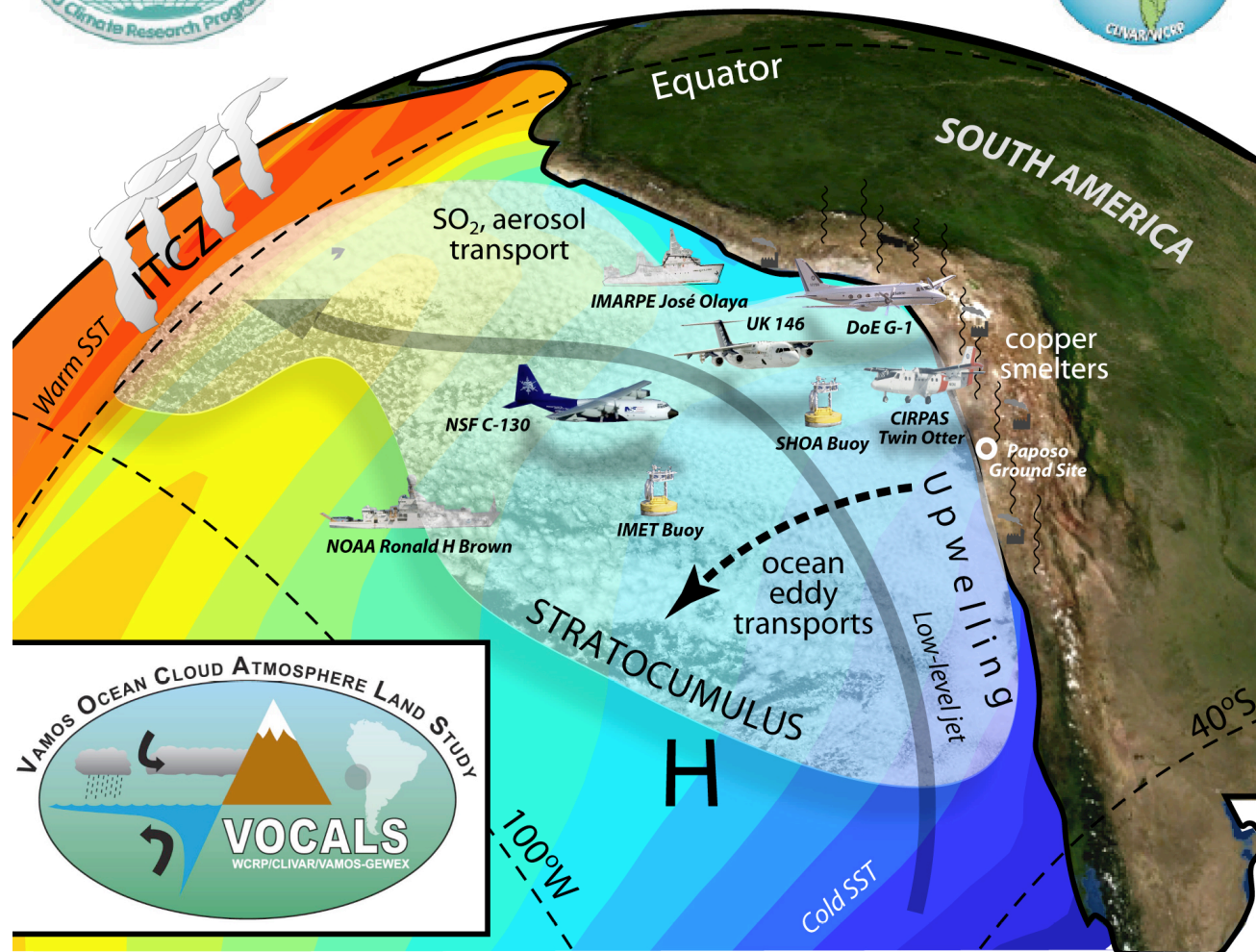


Persistent cloud deck present off the NW coast of Chile is an ideal laboratory for study of aerosol-cloud effects.





VOCALS Regional Experiment



Vocals Aircraft



NSF C-130



Met. Office Bae-146



Met. Office Dornier

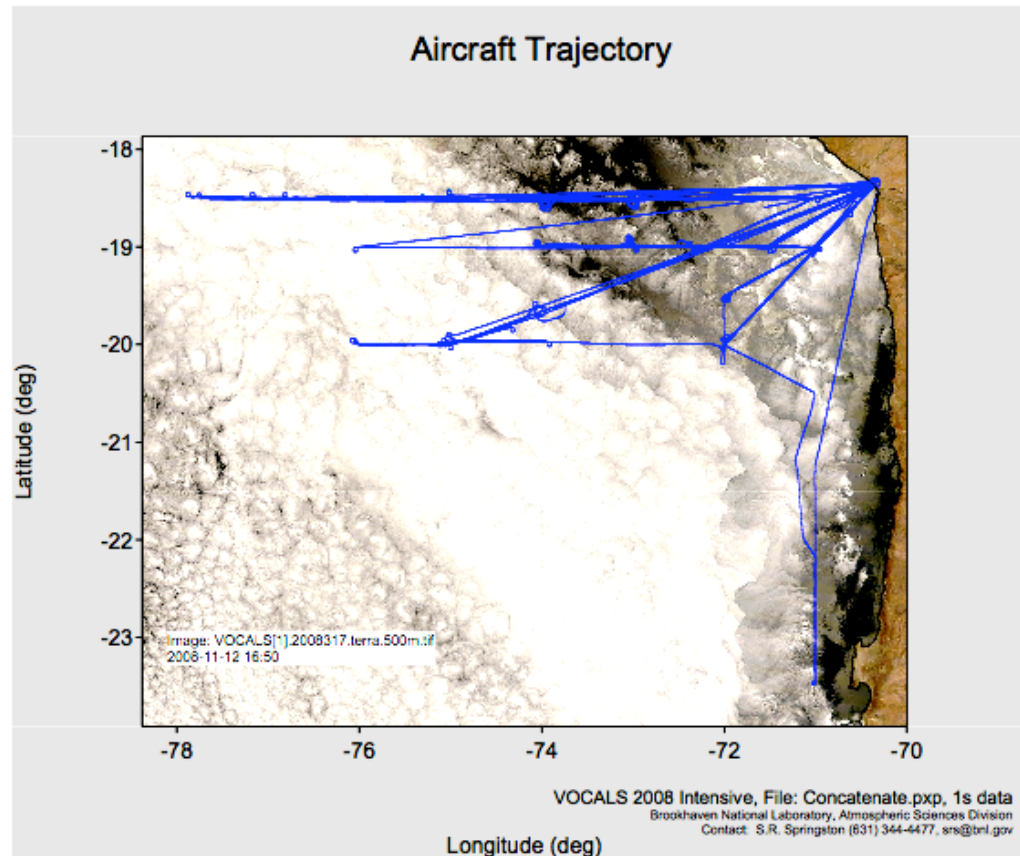


DOE G-1

DOE Participants

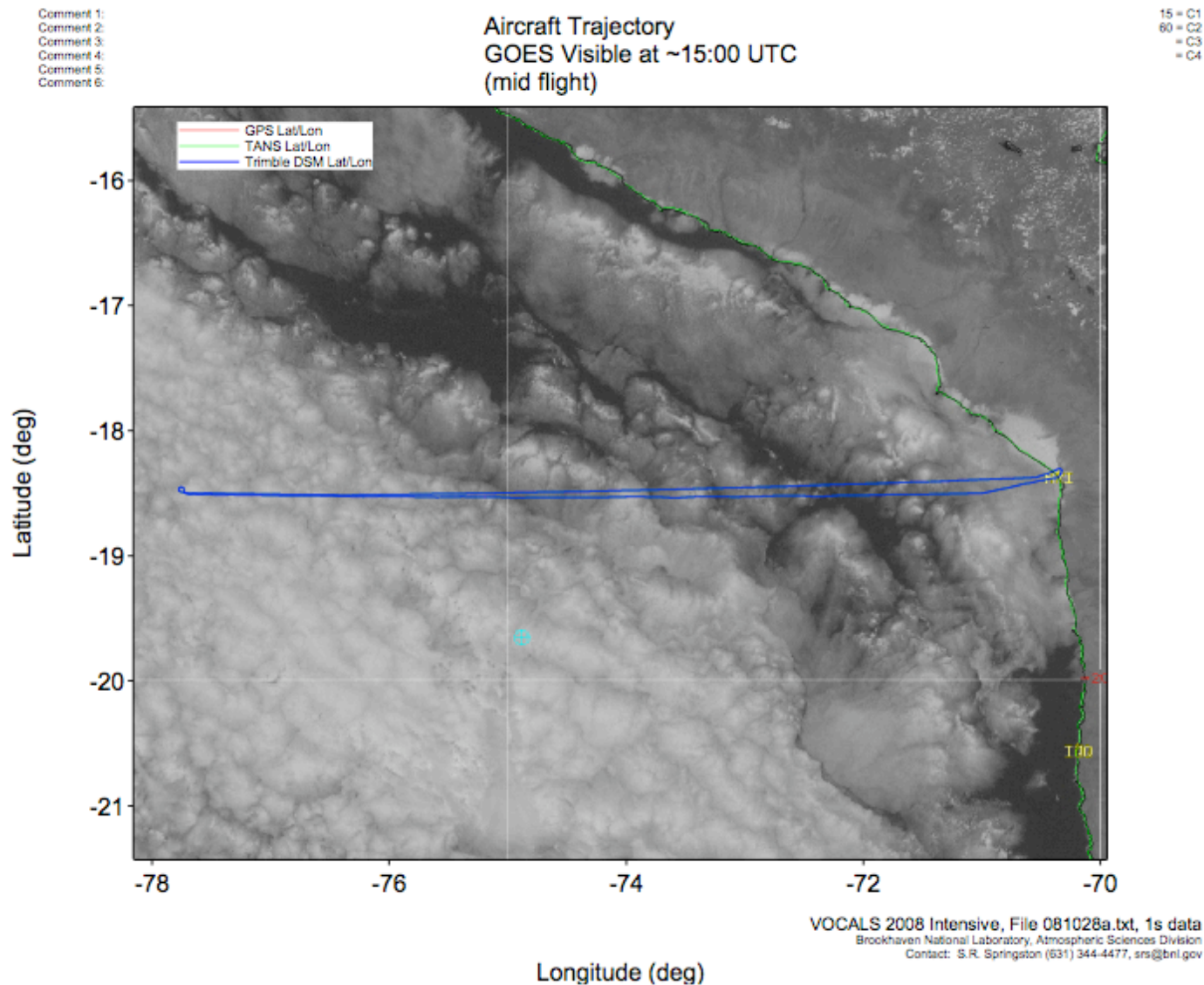


VOCALS G-1 FLIGHTS

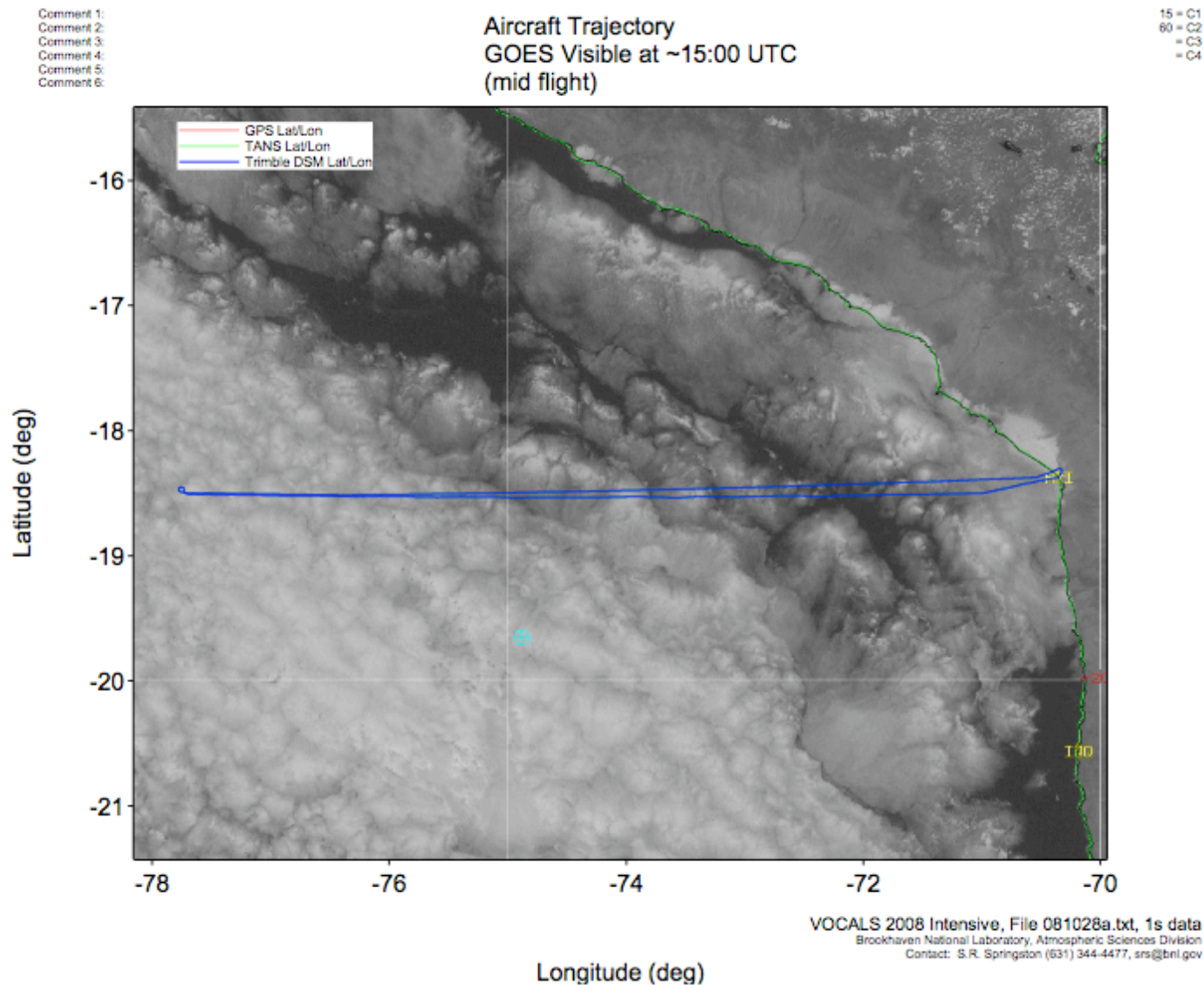


Seventeen flights during the program, mostly E-W to examine gradients in cloud and aerosol properties.

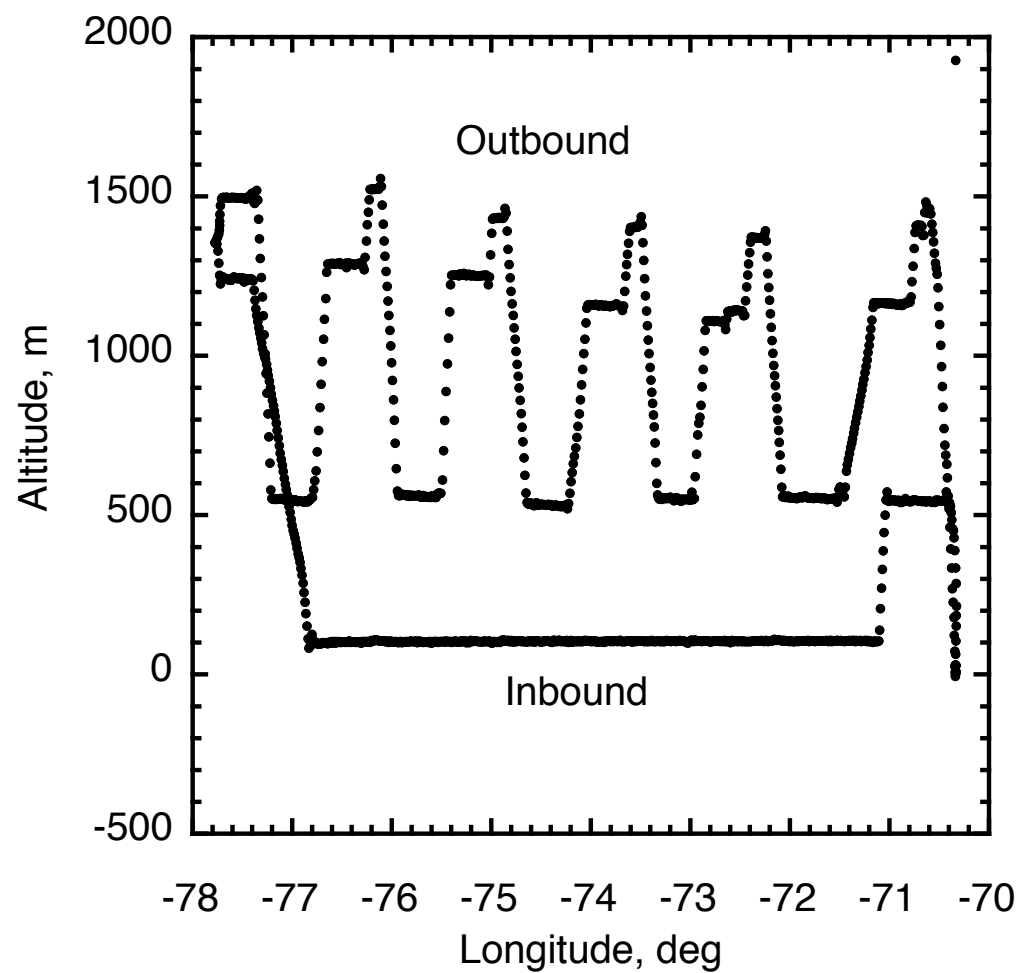
OCTOBER 28 GRADIENT FLIGHT



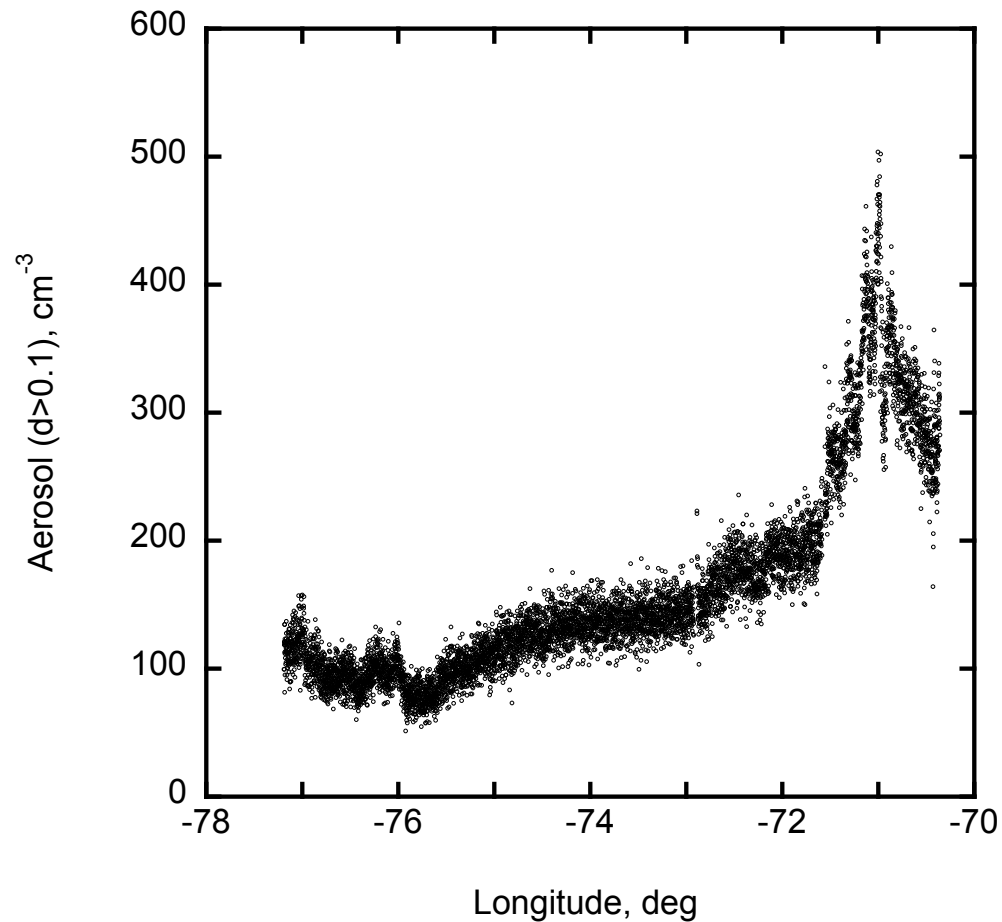
OCTOBER 28 GRADIENT FLIGHT



OCTOBER 28 FLIGHT PROFILE



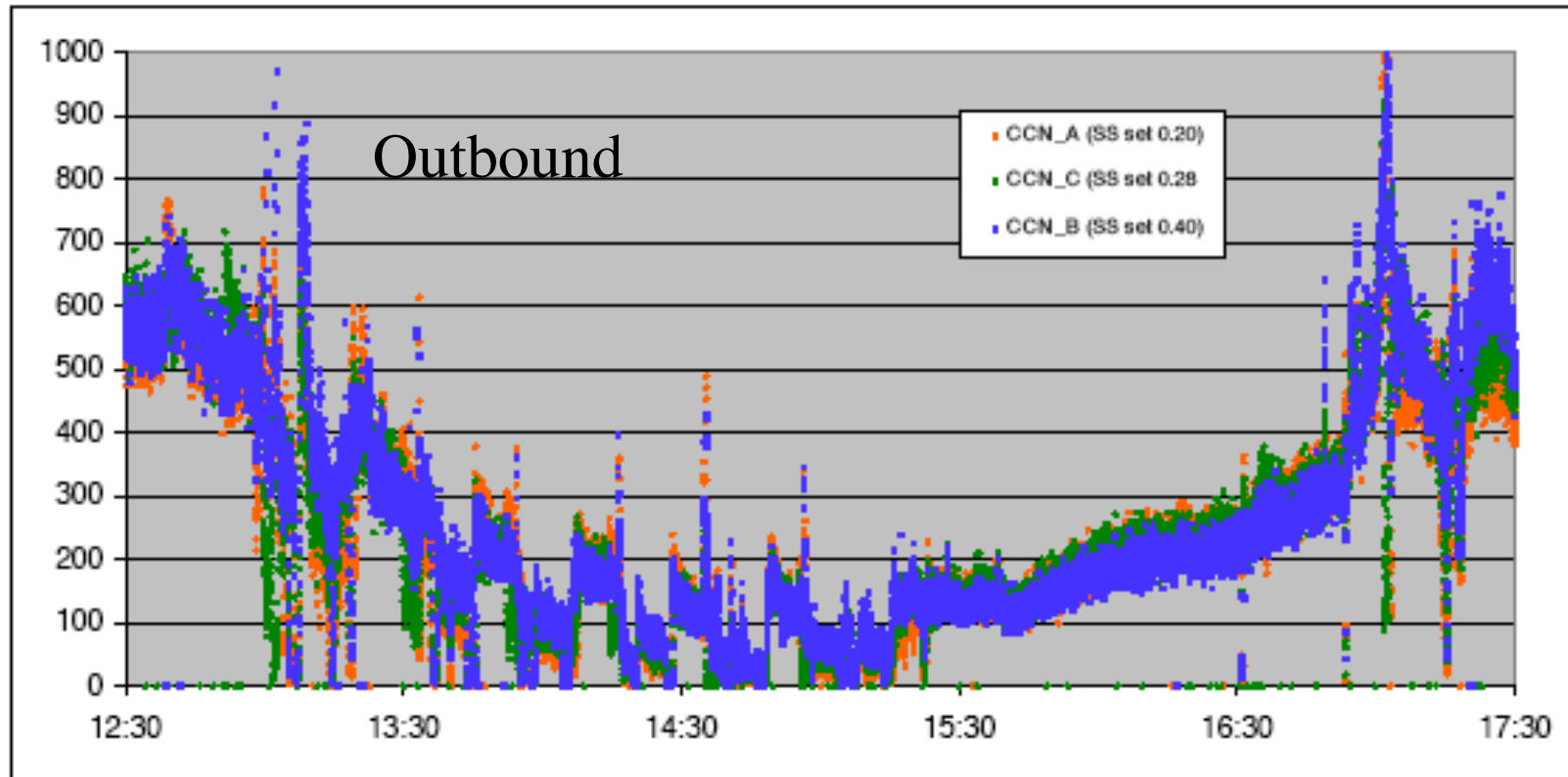
OCTOBER 28 AEROSOL NUMBER CONC.



Smooth decrease in accumulation mode #concentration with distance offshore.

OCTOBER 28 CCN GRADIENT

ALEX LASKIN

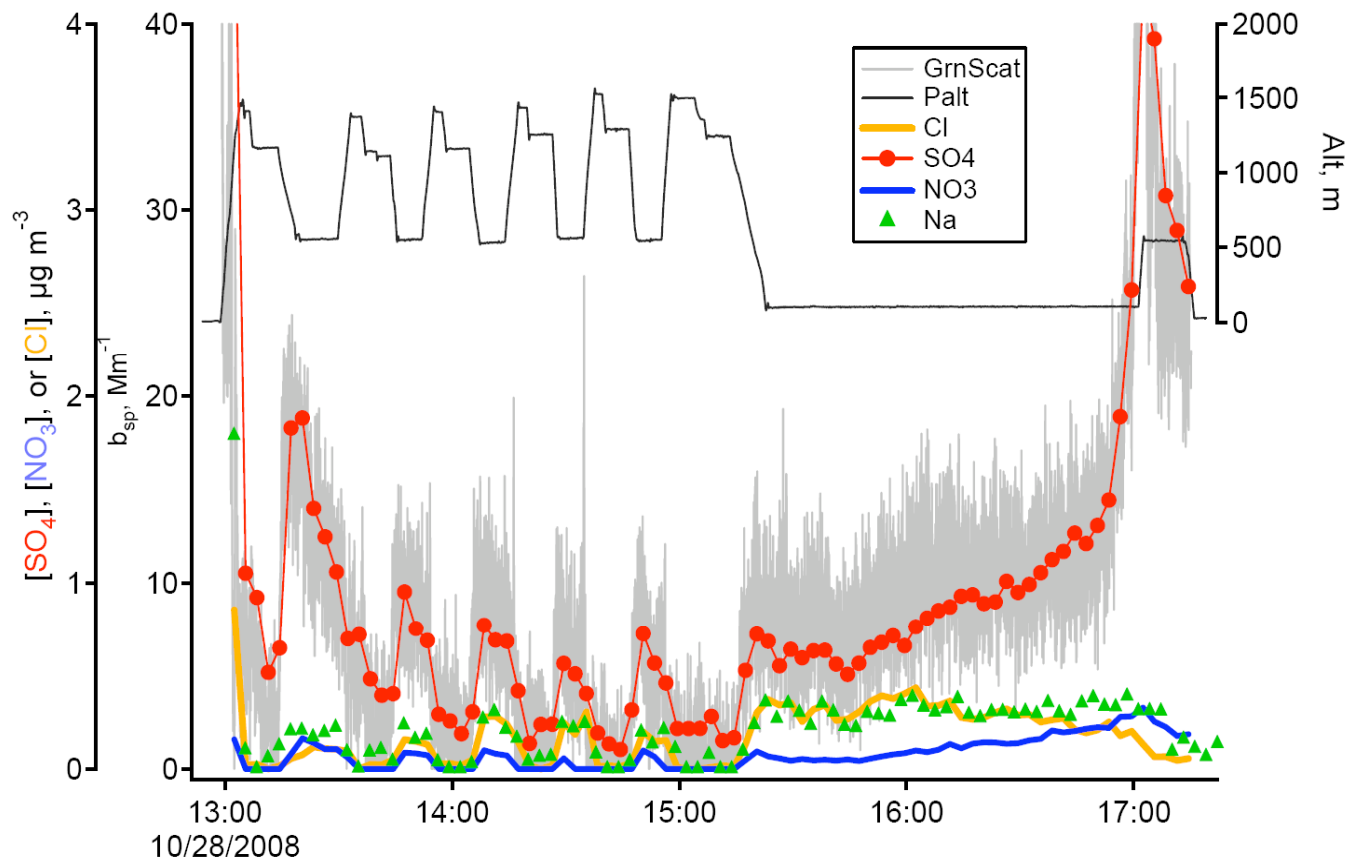


CCN at 3 different %SS identical. All particles activated at 0.2%. Trend identical to PCASP particle concentrations

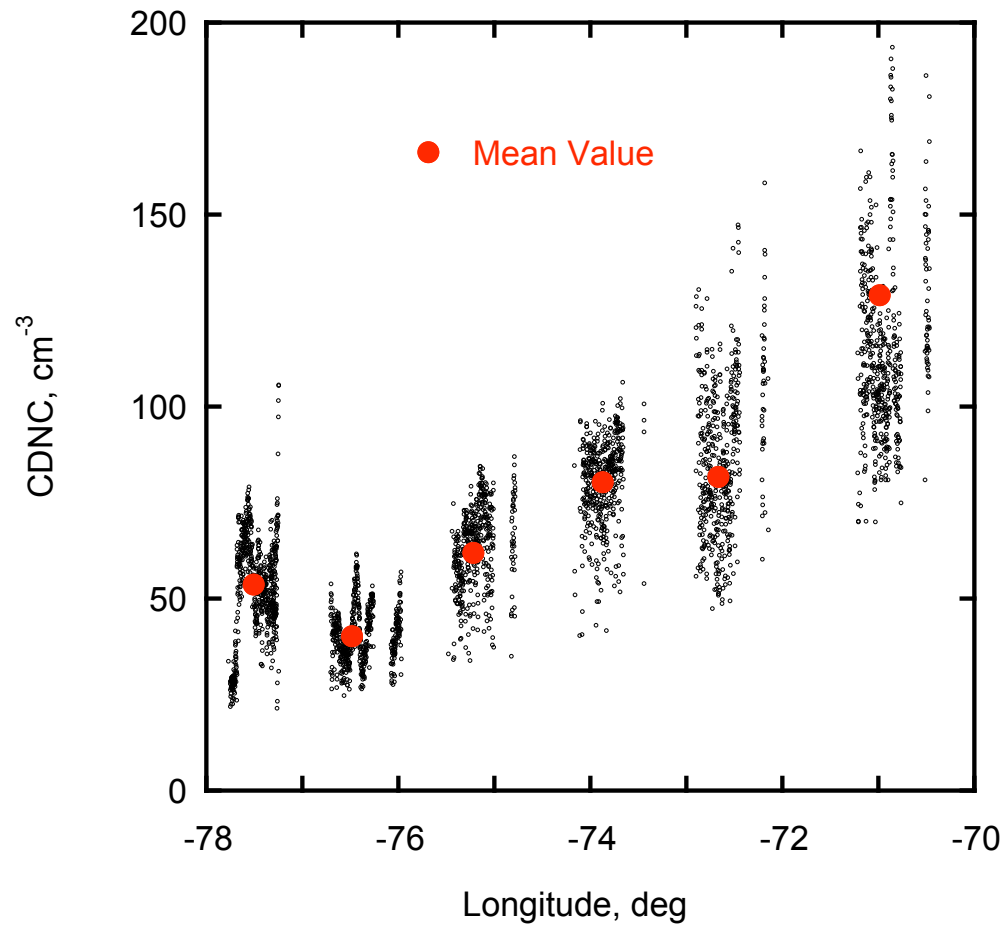
AEROSOL COMPOSITION

TO BE DISCUSSED BY Y-N LEE

081028 G1 Flight: A Gradient Study Along 18.5 S to 76.9 W
(preliminary data)

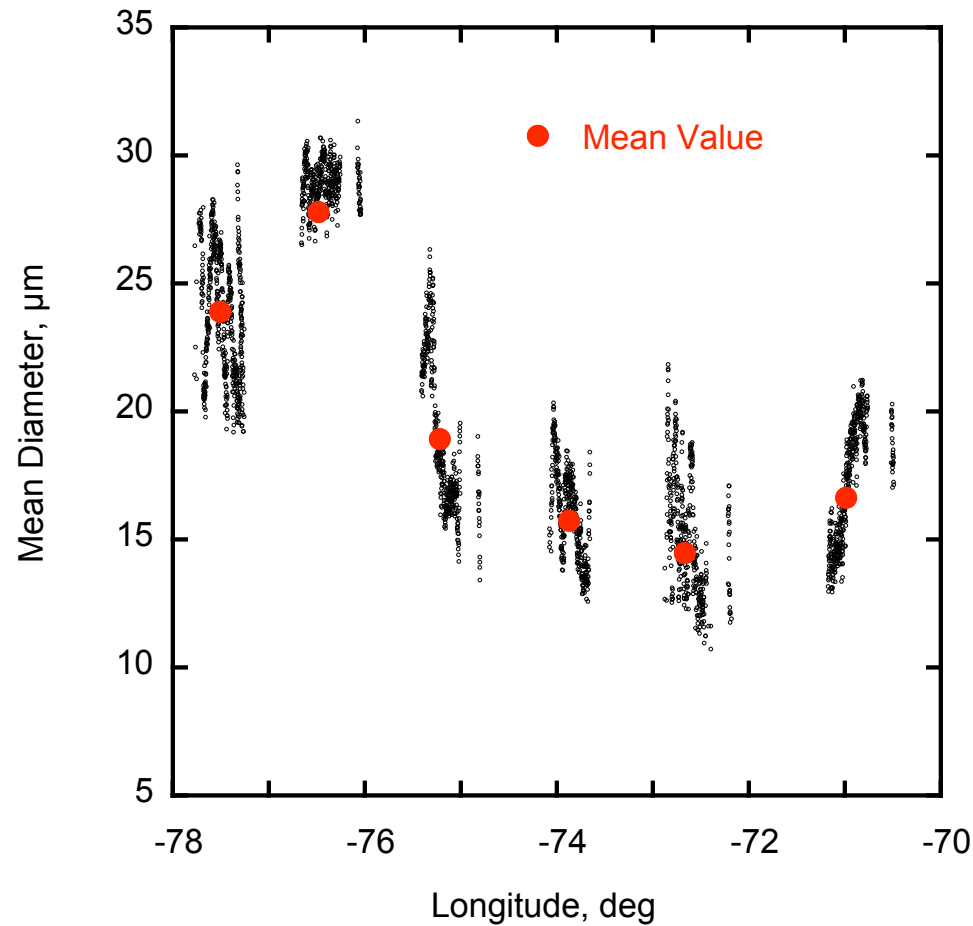


OCTOBER 28 CDNC



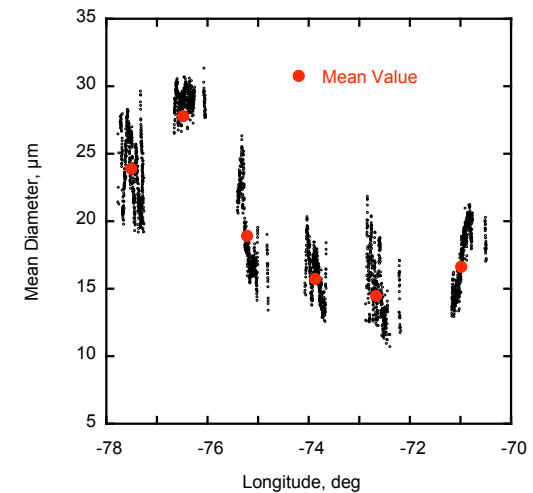
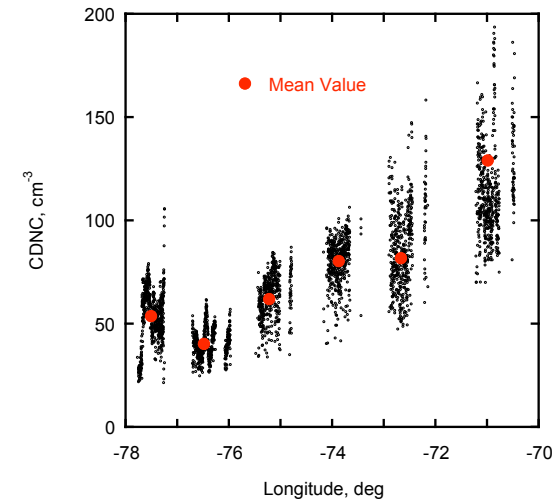
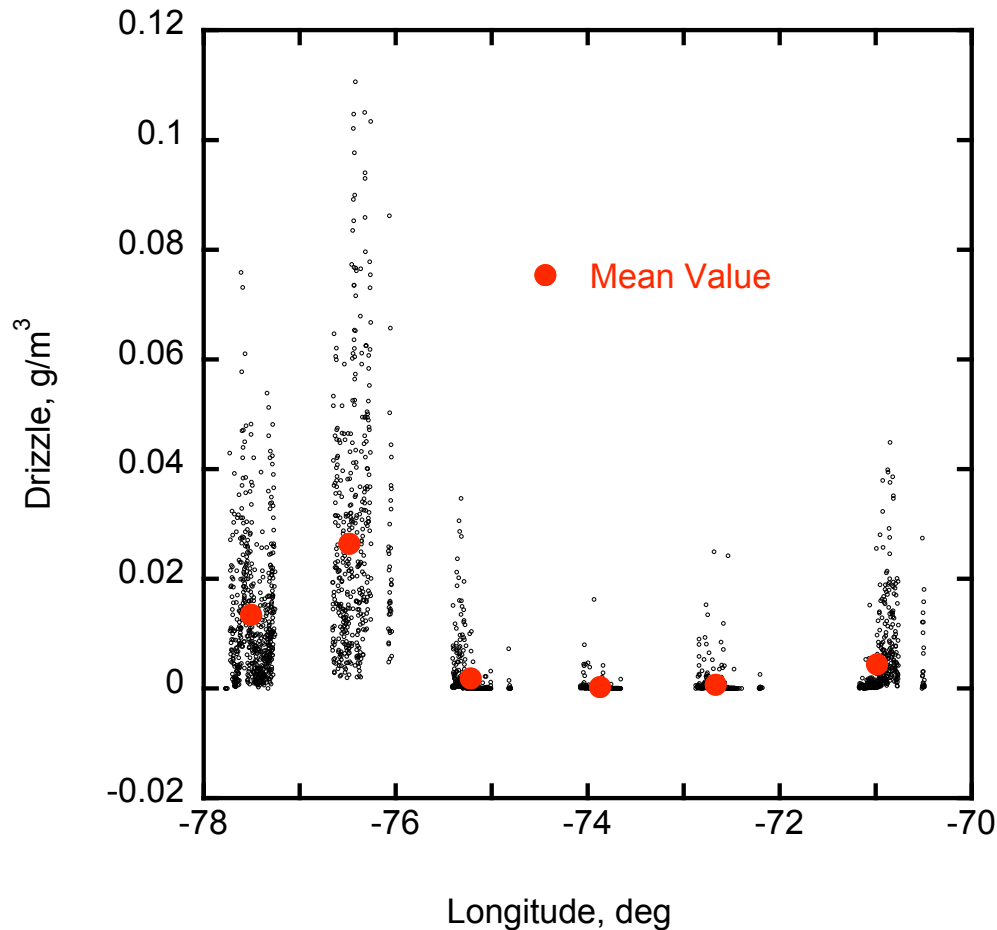
CDNC respond in the expected way to the gradient in aerosol concentration.

OCTOBER 28 DROPLET SIZE



Decrease in CDNC and aerosol concentration with distance offshore is associated with an increase in droplet size.

OCTOBER 28 DRIZZLE



Highest drizzle concentrations associated with lowest droplet concentrations and the largest mean diameters.

AUTOCONVERSION- THE CONVERSION OF CLOUD DROPLETS TO DRIZZLE

Autoconversion rate ($\text{g/m}^3/\text{s}$), $P = P_0 T$

Where-

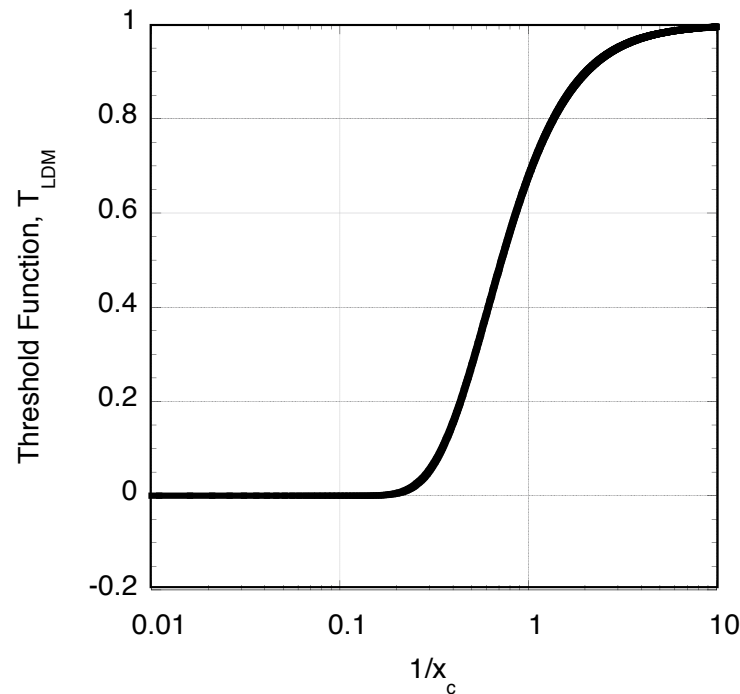
- *T is the threshold function that describes the onset of drizzle.*
- *P_0 is the conversion rate after the onset of the autoconversion process*

THRESHOLD FUNCTION

(Liu, Daum, McGraw, GRL, 2005)

$$T_{LDM} = 1/2(x_c^2 + 2x_c + 2)(1+x_c)\exp(-2x_c)$$

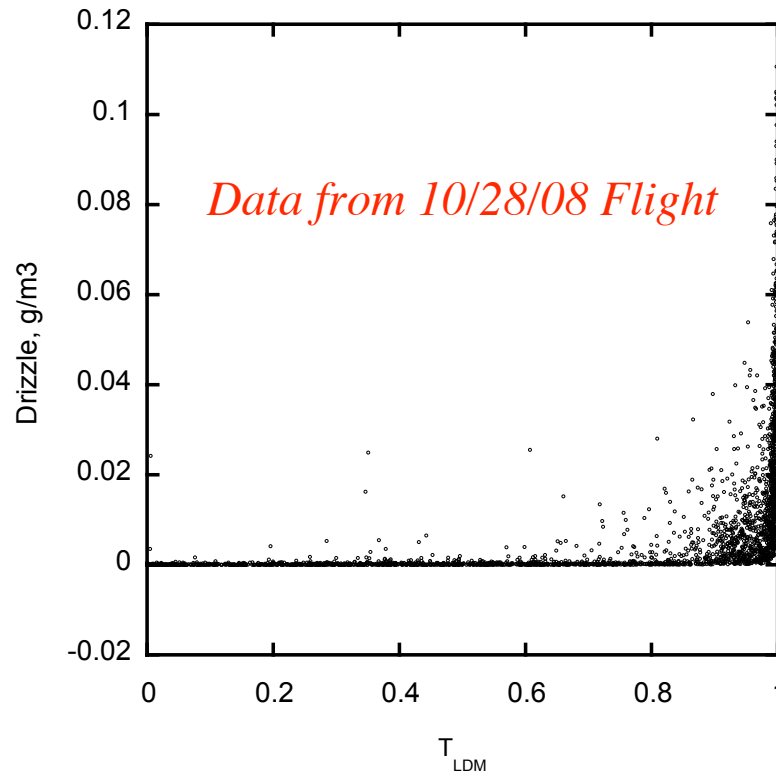
Where, $x_c = 9.7 \times 10^{-17} N^{3/2} L^{-2}$



If cloud microphysics are such that $1/x_c \gg 1$, $P = P_0$ and the cloud drizzles. If $1/x_c \ll 1$, $P = 0$ and the cloud does not drizzle. Transition region $0.3 < 1/x_c < 1.2$.

THRESHOLD FUNCTION

How well does the LDM threshold function work?



Drizzle water concentration is low until $T_{LDM} > \sim 0.8$ then increases exponentially, consistent with LDM theory.

ACKNOWLEDGEMENTS

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Doe- For funding the science and the aircraft